EdgeX Foundry Introduction

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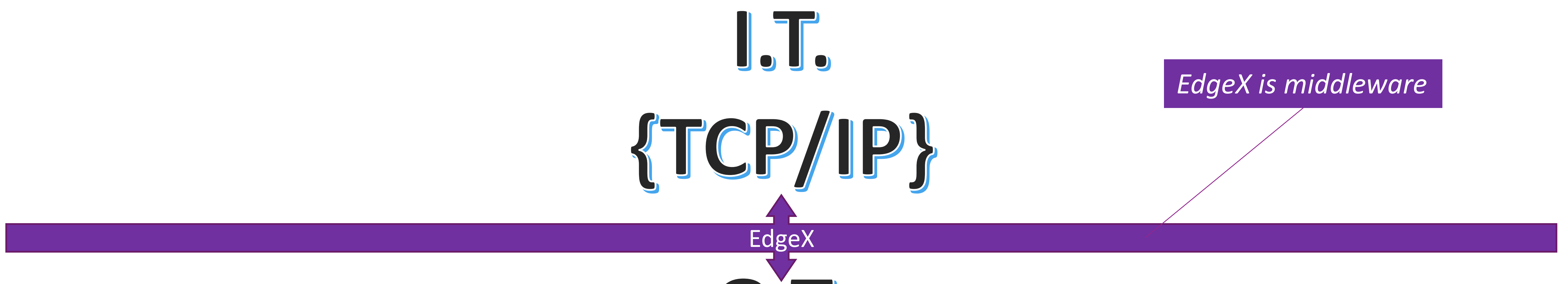
What is EdgeX Foundry?

“Edgey”: our mascot and spirit animal of the project

- An open source, vendor neutral project (and ecosystem)
- A micro service, loosely coupled software framework for IoT edge computing
- Hardware and OS agnostic
- Linux Foundation, Apache 2 project
  - Started April 2017

EdgeX connects “things” to your IT environments



I.T.

{TCP/IP}

EdgeX is middleware

EdgeX

O.T.

Modbus RTU & TCP

ASHRAE BACnet™ IP & MSTP

OPC UA™

OPC UA™ Pub-Sub

{ REST }

MQTT.ORG

Bluetooth™ Low Energy

zigbee

EtherCAT®

EtherNet/IP™

CAN

CANopen®

SIEMENS S7

PROFI® NET

ONVIF®

FILE

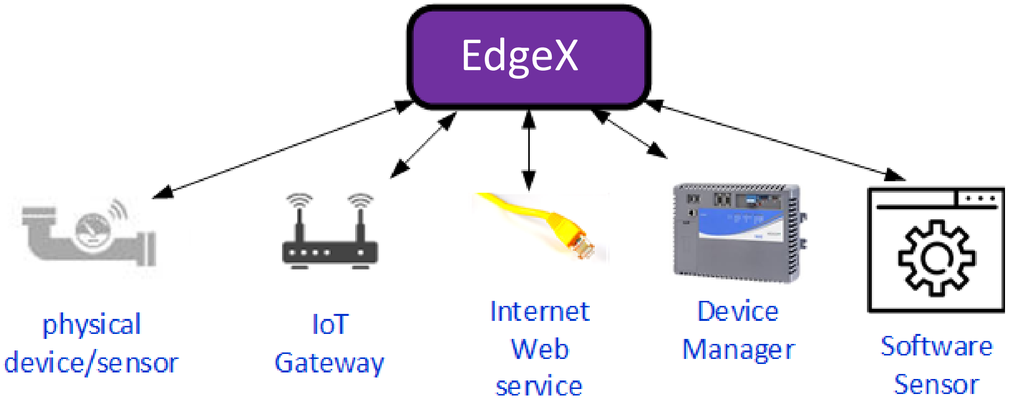
GPS

MEMS

Grove

Connecting Things to IT

- Two way communications with a device or sensor
  - Typically a physical sensor or device (a “thing” in IoT)
    - Examples: a vibration sensor, thermostat, camera, moisture sensor, …
  - Can be a virtual sensor or other system made to look like a sensor
    - Example: getting the weather from the Internet or data passed from another edge gateway
- A micro service speaks a particular protocol
  - Uses that protocol to communicate with the sensor/device
  - Example protocols: Modbus, BACnet, GPIO, MQTT, REST, BLE, …



EdgeX Foundry Goals

- Build and promote EdgeX as the **common open platform unifying edge computing**
- Enable and encourage the rapidly growing community of IoT solutions providers to **create an ecosystem of interoperable plug-and-play components**
- Provide **tools to quickly create EdgeX-based IoT edge solutions**
- **Collaborate** with relevant open source projects, standards groups, and industry alliances to ensure consistency and interoperability across the IoT

A Brief EdgeX History

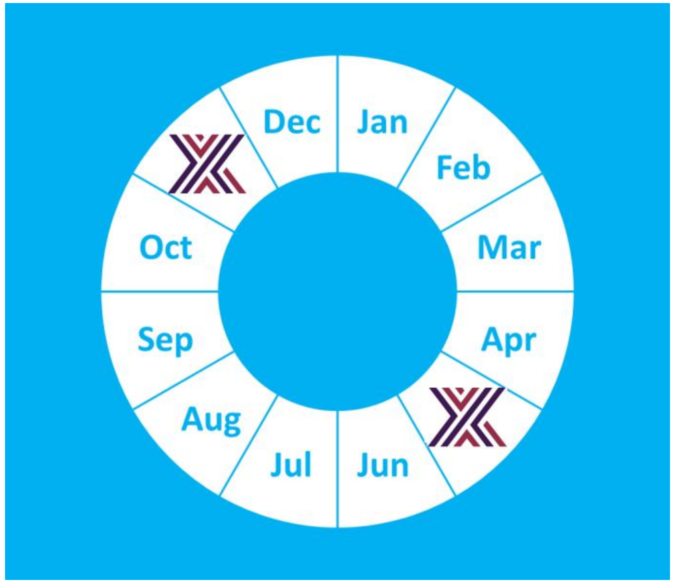
- Chartered by Dell IoT marketing in July 2015
  - A Dell Client CTO incubation project (Project Fuse)
- Designed to meet interoperable and connectivity concerns at the IoT edge
- Started with over 125,000 lines of Dell code
- Entered into open source through the Linux Foundation on April 24, 2017
  - Started with nearly 50 founding member organizations; today we have more than 75
- Release Cadence: 2 formal releases a year
  - Barcelona – Oct 2017
  - California – Jun 2018
  - Delhi – Oct 2018
  - Edinburgh – July 2019
  - Fuji – Oct 2019
  - Geneva – May 2020
  - Hanoi – Nov 2020
  - Ireland – June 2021 (v2)
  - Jakarta – Nov 2021 (first LTS)
  - Kamakura – May 2022

  Levski – Nov 2022

  Minnesota – May 2023 (EdgeX 3.0?)

  Napa – Nov 2023 (next LTS)

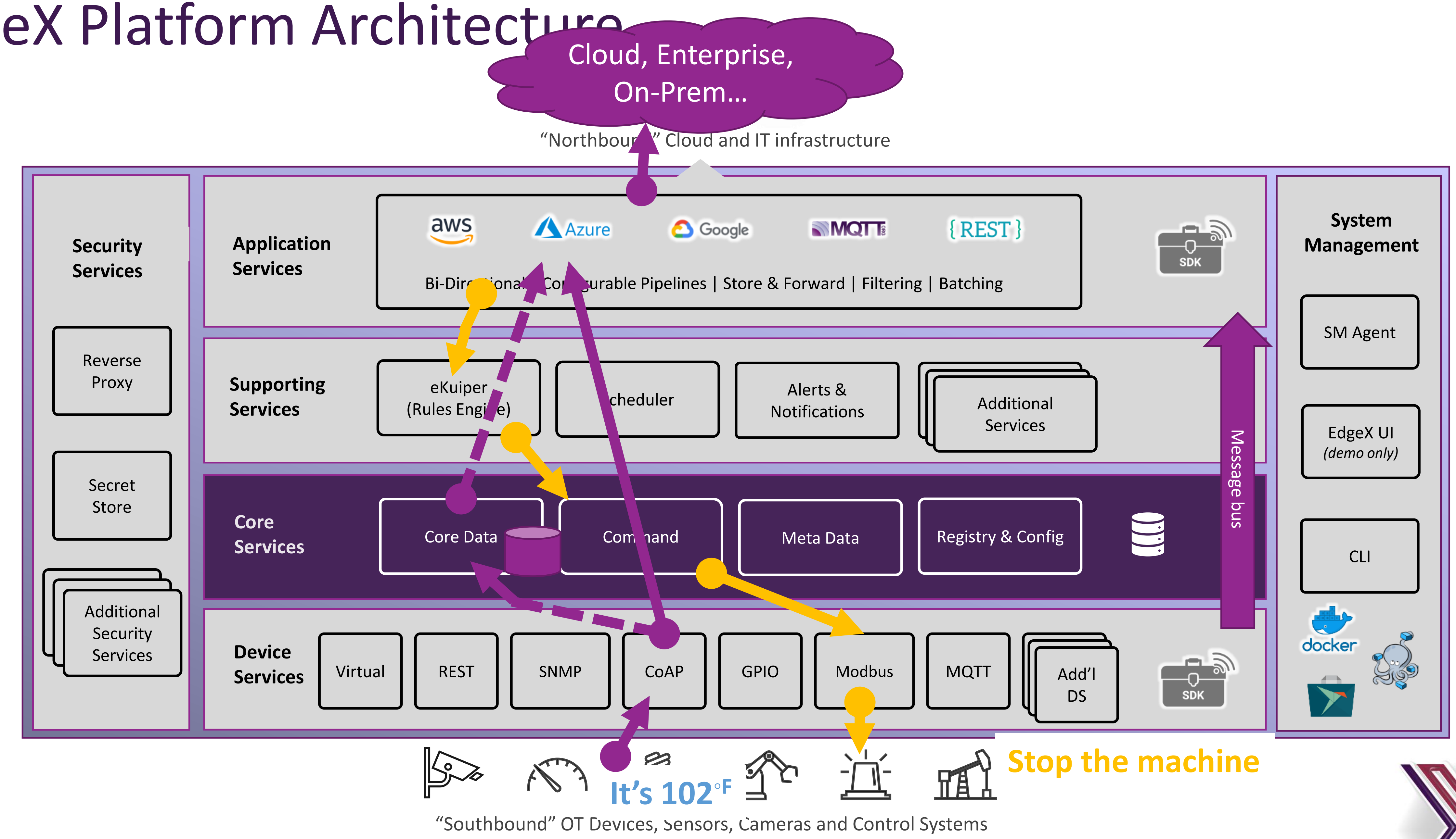
  Odessa – May 2024



EdgeX Primer - How it works

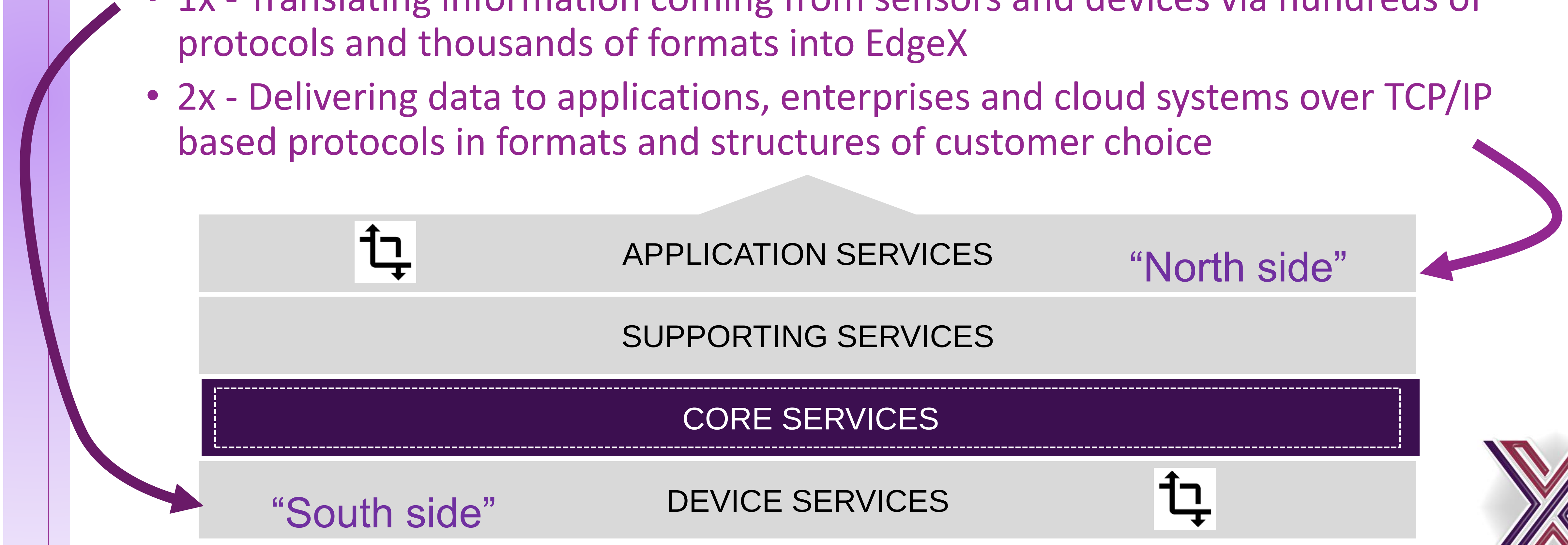
- A collection of a dozen+ micro services
  - Written in multiple languages (Go, C, Java, … we are polyglot believers!!)
- EdgeX data flow:
  - Sensor data is collected by a **Device Service** from a thing
  - Data is passed to the **Core Services** for local persistence
  - Data is then passed to **Application Services** for transformation, formatting, filtering and can then be sent "north" to enterprise/cloud systems
  - Data is then available for edge analysis and can trigger device actuation through Command service
  - Many others services provide the supporting capability that drives this flow
- REST communications between the service
  - Some services exchange data via message bus (core data to export services and rules engine)
- Micro services are deployed via Docker and Docker Compose

EdgeX Platform Architecture



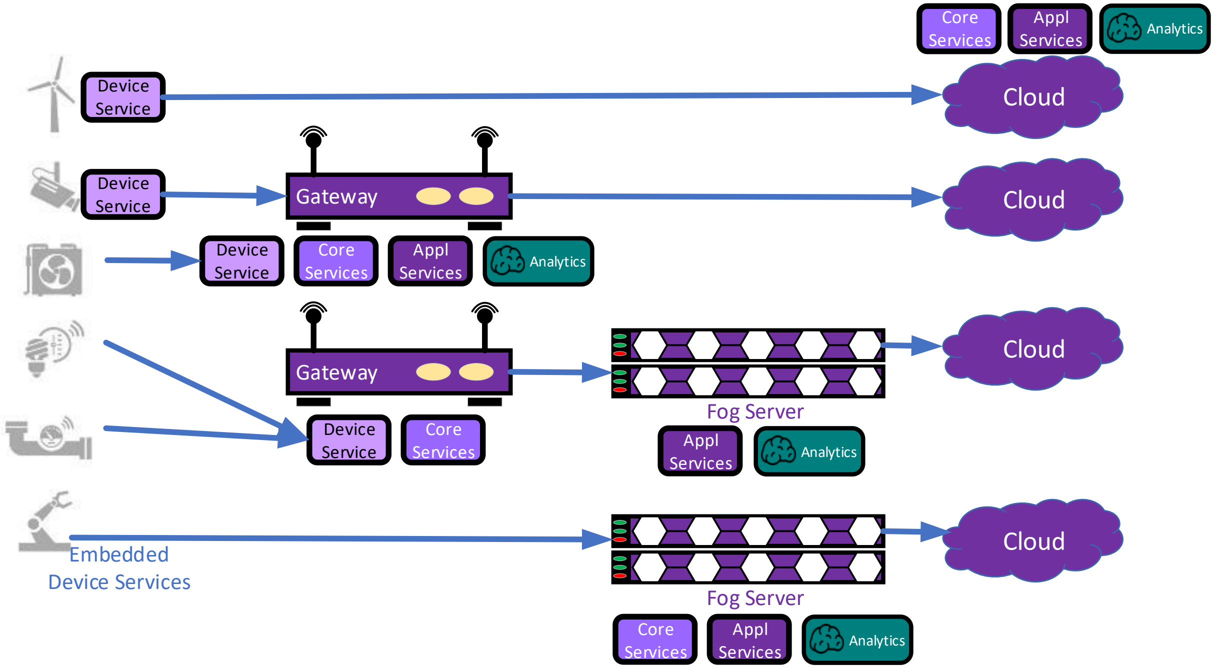
Boiling it down

- Crudely speaking, the layers (and services) of EdgeX constitute a dual transformation engine
  - 1x - Translating information coming from sensors and devices via hundreds of protocols and thousands of formats into EdgeX
  - 2x - Delivering data to applications, enterprises and cloud systems over TCP/IP based protocols in formats and structures of customer choice



EdgeX Enables Tiered Fog Deployments

- In today's IoT landscape, it is imperative to leverage compute, storage, network resources where ever they live
- Loosely-coupled architecture enables distribution across nodes to enable tiered edge/fog computing
- Scope includes embedded sensors to controllers, edge gateways and servers
- Quantity and function of micro services deployed on a given node depends on the use case and capability of hardware



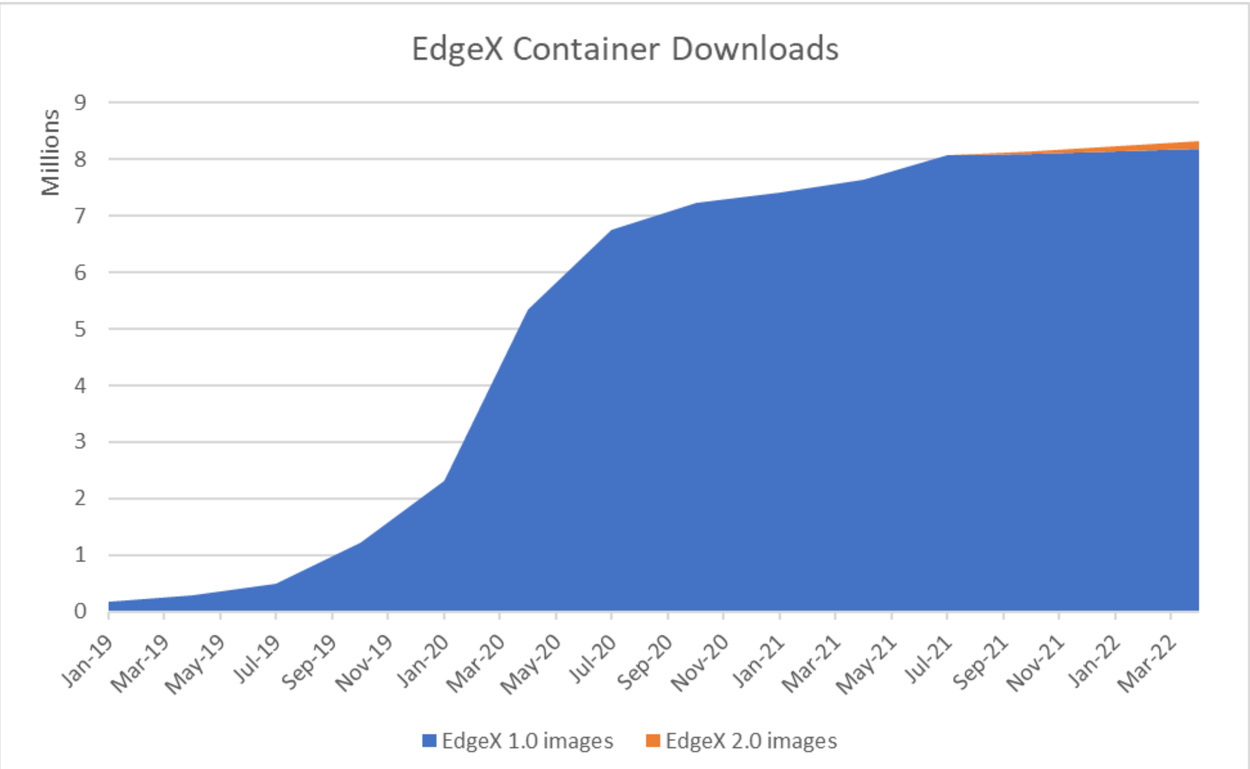
Performance Characteristics

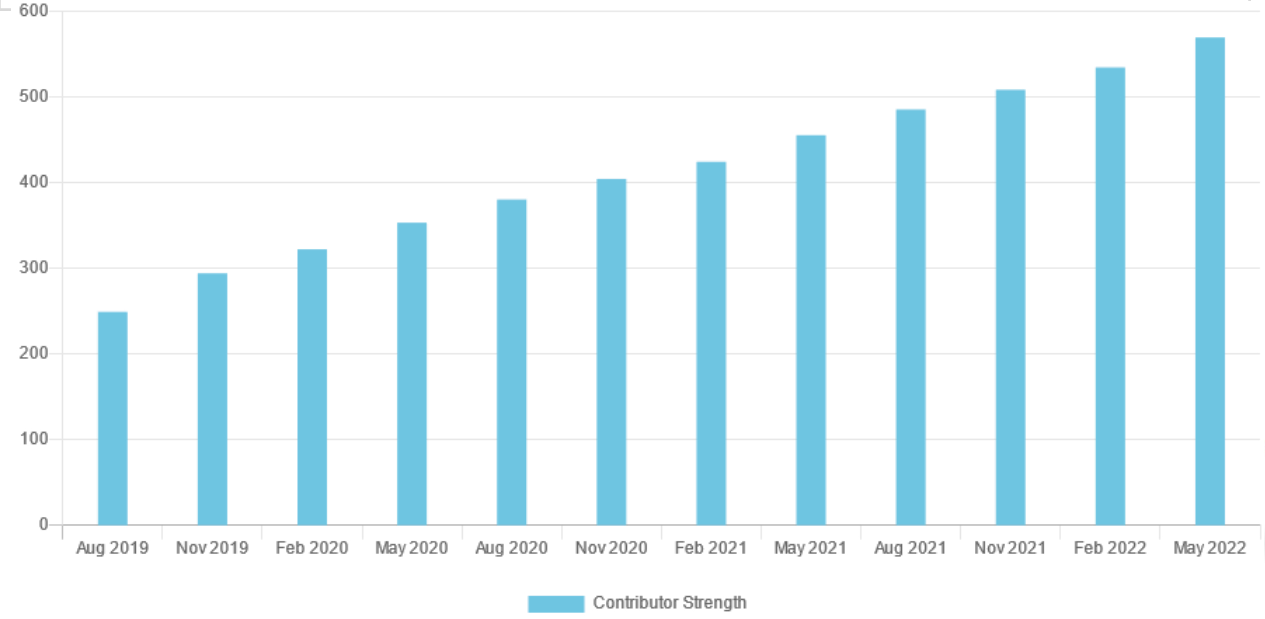
- Our platform goals since our first release
  - Be able to run on a Raspberry Pi 3 type of device
    - 1 GB RAM, 64bit CPU, at least 32GB storage space
  - Additional “developer community” targets
    - Startup in 10 seconds or less (post OS boot)
    - Latency for one piece of data from data ingestion to actuation will be < 1 second

- Ireland Release – the current state
  - Memory: 403MB
    - EdgeX services minus 3rd party (Consul, Vault, etc.): ~100MB
    - Minimal EdgeX Deployment: 39MB
  - CPU: 28% maximum
    - Minimal EdgeX Deployment: 6%
  - Container size: 1020MB
    - Consul takes 115MB
    - Kong and Vault take >500MB
    - Minimal EdgeX Deployment: 112MB
  - Data from DS to export time = < 3ms
  - Test Platform
    - Running on HP MP9 gateway
    - Intel Core i7-8700T processor @2.4GHz
    - 16GB RAM
    - Ubuntu 20.04 LTS OS
  - Test includes Redis, Consul, Kuiper, Kong, Vault and 2 device services (REST and virtual device)

Project Momentum

- Over 225 EdgeX contributors
- > 8.2 million container downloads
- ~ 870K deployments
- ~ 2-3K website users a month
- ~20-30 global contributors per month
- > 200 commits per month
- See Insights | Linux Foundation for more details





EdgeX Foundry Adoption

- EdgeX is incorporated into these products today
  - IOTech Systems
    - IOTech's Edge Xpert – the commercially supported version of EdgeX
  - Accenture AIP+
    - AIP+ is Accenture's collection of modular, pre-integrated AI services and capabilities, designed to make it significantly easier to adopt AI
  - ThunderSoft TurboX Smart Core Platform
    - Platform to drive faster development of innovative smart devices on the edge
  - Jiangxing Intelligence EdgeBox
    - An advanced AIoT edge computing system
  - HP – HP Engage Edge – the world's first retail product powered by the EdgeX Foundry
    - https://press.hp.com/us/en/blogs/2020/hp-unveils-hp-engage-edge.html
  - Tibco Project Air
    - Enables centralized access and management of IoT devices, efficient processing and storage of IoT derived data, and support for running analytics both at the edge and in the cloud
  - HomeEdge – open source project under LF Edge
    - A robust, reliable and intelligent home edge computing open source framework
- See the EdgeX Vertical Solutions Working Group for details and recordings from these groups

Where is EdgeX Foundry used?

- Utilities (Power, Gas, Water):
  - Remote monitoring telemetry of supply networks and consumer meters
  - Supply network optimisation
  - Fault detection and management
  - Predictive maintenance of plant and assets
- Manufacturing:
  - Manufacturing process monitoring, control and optimisation
  - Stock and materials tracking
  - Predictive maintenance of plant and assets
  - Worker health and safety
- Retail:
  - Fraud / loss prevention
  - Customer buying patterns and targeted promotions
  - Real-time stock management
- Smart Buildings & Cities:
  - Energy use monitoring and optimisation
  - Public safety and security
  - Transportation monitoring, capacity and route optimisation
  - Environment / incident response
- Oil & Gas / Mining / Chemicals:
  - Process monitoring, control and optimisation
  - Material flow optimisation
  - Predictive maintenance of plant and assets
  - Worker health and safety
- Transportation:
  - Route monitoring / optimisation
  - Semi-autonomous vehicle control
  - Predictive maintenance of vehicles

Resources

- Code
  - github.com/edgexfoundry
- Docs
  - docs.edgexfoundry.org (note selection for each version)
- Slack
  - edgexfoundry.slack.com (lots of channels– use #general when you are not sure)
- EdgeX YouTube Channel
  - www.youtube.com/channel/UC30DbbsoqbkGJYJ5omJJsng
  - Just search for EdgeX Foundry
- Social Media
  - Email Forum ☛ https://lists.edgexfoundry.org/mailman/listinfo
  - Twitter ☛ https://twitter.com/EdgeXFoundry
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Questions And Some Answers

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A Linux Foundation project under LF EDGE